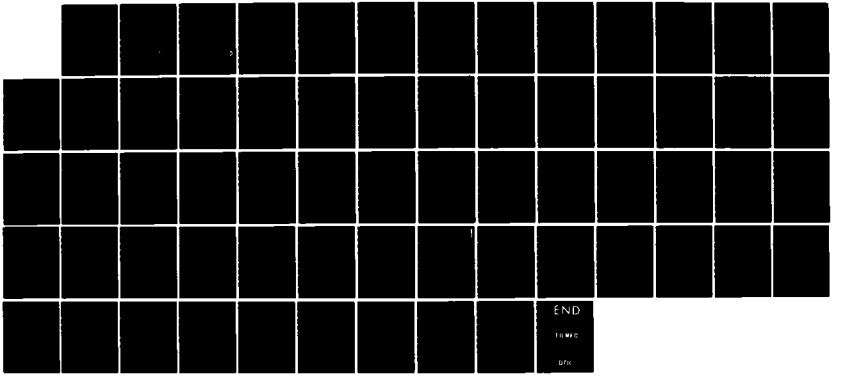
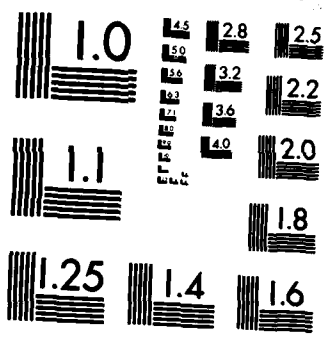
AD-A153 380 TECHNOLOGY PERSONAL ATTRIBUTES AND THE PERCEIVED AMOUNT AND FOCUS OF ACCO.. (U) TEXAS A AND M UNIV COLLEGE STATION DEPT OF MANAGEMENT N B MACINTOSH ET AL. MAR 85 1/1

UNCLASSIFIED TR-DG-12-ONR N00014-83-C-0025 F/G 5/1 NL





Organizations As Information Processing Systems

Office of Naval Research Technical Report Series

Technology, Personal Attributes and the Perceived Amount and Focus of Accounting and Information System Data

N. B. Macintosh
R. L. Daft

TR-ONR-DG-12

March 1985

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NR 170-950

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Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER TR-ONR-DG-12	2. GOVT ACCESSION NO. AD-A153380	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Technology, Personal Attributes and the Perceived Amount and Focus of Accounting and Information System Data		5. TYPE OF REPORT & PERIOD COVERED Technical report 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) N. B. Macintosh and R. L. Daft		8. CONTRACT OR GRANT NUMBER(s) N00014-83-C-0025
9. PERFORMING ORGANIZATION NAME AND ADDRESS College of Business Administration Texas A&M University College Station, TX 77843		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS NR170-950
11. CONTROLLING OFFICE NAME AND ADDRESS Organizational Effectiveness Research Programs Office of Naval Research Arlington, VA 22217		12. REPORT DATE MARCH ~~February~~ 1985 13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approval for public release: distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

accounting information	management information systems
cognitive style	information design
data processing	user task
information processing	information processing

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Characteristics of cognitive style and managerial tasks are related to the way managers perceive and use formal accounting and information system data. Data were collected from 142 respondents in 24 departments of several organizations. The findings suggest that when tasks are well defined, managers preferred a large amount of formal accounting information system data. For ill-structured tasks, respondents tended to prefer multiple focus information that required greater interpretation. The tasks of information users showed a more

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S/N 0102-014-6601

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consistent relationship with information preference than did the cognitive style of users.

TECHNOLOGY, PERSONAL ATTRIBUTES AND THE PERCEIVED AMOUNT AND FOCUS OF ACCOUNTING AND INFORMATION SYSTEM DATA

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August 1984

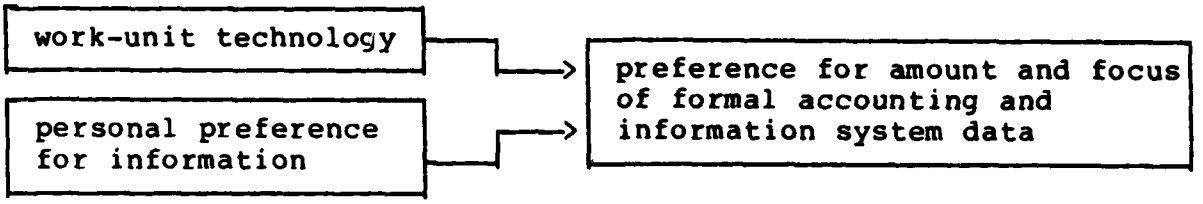
Formal management accounting and information systems, no matter how well designed from a technical viewpoint, do not always have impact on the organization in the manner intended by the designer (Argyris, 1952; Ackoff, 1967; Argyris, 1977; Earl and Hopwood, 1980; Burchell et al., 1982). Research oriented toward understanding the behavioral basis for the use of accounting and information system data is considered important (Hopwood, 1978). New understanding of how and why accounting information is used in organizations will eventually help make formal information systems more effective.

Behavioural accounting investigations have followed one of two quite different approaches to the problem of information utilization. Many studies have focused on personal attributes of the system user (e.g. Huysmans, 1970; Swieringa and Moncur, 1972; Mock et al., 1972; Dermer, 1973; Lusk, 1973; Driver and Mock, 1975; Lucas, 1975; Benbasat and Schroeder, 1977; Bariff and Lusk, 1977; Wright, 1977; Vasarhelyi, 1977; Lucas, 1981; Benbasat and Dexter, 1982; Brownell, 1983). Findings from this research indicate that people select or discard information based on their cognitive or decision making styles. Other studies have investigated how forces in the organization's setting impact on accounting and information systems (Khandwalla, 1972; Galbraith, 1973; Bruns and Waterhouse, 1975; Sathe, 1975; Watson and Baumler, 1975; Banbury and Nahapiet, 1979; Hayes, 1977;

Waterhouse and Tiessen, 1978; Tushman, 1979; Ginzberg, 1980; Merchant, 1981; Birnberg et al., 1983; Flamholtz, 1983; Hayes, 1983). These findings suggest that patterns of organization structure, technology or environment may influence both the availability and need for formal accounting information, and hence determine the extent to which this information is used in decision making.

Both approaches to the problem of information use have provided findings that are relevant to the design of accounting and information systems. Yet by and large, the personal attributes studies have paid little attention the the effect of contextual forces such as environment, technology and organizational structure. At the same time, studies of context have tended to ignore the cognitive and personality characteristics of system users. As a result, many experts have suggested that an important next step is for research that includes both personal and organizational variables (Swieringa and Moncur, 1972; Mason and Mitroff, 1973; Dermer, 1975; Driver and Mock, 1977; Dickson et al., 1977; Savich, 1977; Bariff and Lusk, 1978; Chervanny and Dickson, 1978; McGhee et al., 1978; Benbasat and Dexter, 1979; Driver and Rowe, 1979; Zmud, 1979; Henderson and Nutt, 1980; Brownell, 1982). The purpose of this paper is to report the results of a field study which included both types of variables. A model is proposed that combines work-unit technology and two information related

cognitive traits. Data were collected to determine the relationship of these variables to the way participants used and perceived formal accounting and information systems while on the job. The findings provide an initial look at the role of personal versus organizational factors in information use. The general model that guided the research is shown below:



THE DEPENDENT VARIABLE: INFORMATION CHARACTERISTICS

Formal accounting and information systems have many attributes. For this study we selected two attributes, the amount of information and the focus of information, that have been identified by previous researchers (Dermer, 1973; Galbraith, 1973; Lawler & Rhode, 1976; Mock, 1976; Belkaovi, 1980). The "amount" variable is the volume or quantity of formal information about organizational activities that is gathered and interpreted by organizational participants (Daft and Macintosh, 1981). The amount of information has been shown to be an important aspect of judgmental processes (Snowball, 1980). Amount refers to on-the-job information processing such as gathering, storing, interpreting and synthesizing data (Tushman and Nadler, 1978). Sometimes the amount is high--the user examines all relevant data

and massages it carefully until at least one excellent solution emerges. In other instances the amount is low--the user processes just enough data to make an adequate decision and then moves on (Driver and Mock, 1975; Savich, 1977; McGhee et al., 1978). The amount of formal information processed is relevant to decision making and control; if not enough is processed decisions can be information poor but too much processing can lead to information overload (Lawler and Rhode, 1976).

The degree of focus inherent in any formal accounting and information system is another attribute of the system that is relevant to decision making (Mason, 1969; Weick, 1969; Dermer, 1973; Driver and Mock, 1975; Dyckman, 1981). Normally, it is assumed that formal information systems contain a clear, unequivocal message for users that leads to a single, uniform interpretation. Accounting systems, particularly for the recordkeeping function, traditionally have been thought of as delivering single focus information. Yet for many formal accounting and information systems the message is equivocal and can lead to multiple interpretations. A discretionary cost center budget, for example, does not contain an unambiguous message about performance--all it says is that actual spending was more or less than planned (Anthony and Dearden, 1980). A "dialectic" information system relies on inherent ambiguity in the information available (Mitroff and Mason, 1983). Multiple focus information lends itself to different, even conflicting

interpretations about work related decisions, whereas single focus information is clear and specific and leads to a single interpretation.

THE INDEPENDENT VARIABLES: TASK VARIETY AND ANALYZABILITY

Technology

The idea that patterned differences in organizational technology or workflow can influence the way organizational participants use and perceive formal accounting systems has received considerable support. Hofstede (1967), for example, after investigating the human relations aspects of budgetary control systems, concluded that technology has an important impact on financial control systems. Flamholtz (1975) argued that the degree of programmability of the task influences the way standards for management accounting systems are established. Dermer (1975) suggested that task attributes (including uncertainty, novelty, complexity and degree of structure) might have an important influence on the amount, content, form and utilization of accounting information systems. Bruns and Waterhouse (1973) discovered that the degree of structuring for organizational activities influenced the budget-related behavior of managers. Hopwood (1976) concluded that the nature of a firm's technological processes determine the relevance of its management accounting system. Lawler and Rhode (1976) maintained that accounting and information systems will fail unless designed to suit the technology of the organization. Tushman and Nadler

(1978) argued that non-routine technology imposes greater demands than routine technology on the quality and kind of information processing. Technology, then, is one variable in the organizational context that has potential influence on accounting and information systems.

Perrow (1970) defined technology as the techniques, activities, and knowledge applied to organizational inputs or raw materials to transform them into outputs. From this perspective technology can be analyzed in terms of two properties--the variability in the transformation process and the nature of the search procedures used to solve problems. Variety in the workflow can be thought of as a continuum. High variety means that tasks change frequently, tasks are not routine, and new problems frequently arise. Low variety means that work activities are similar and repetitious. Most tasks are familiar, and few novel problems appear.

The analyzability of technology also can be conceived of as a continuum. At one end the transformation process is highly analyzable and well defined. There are known ways of doing the work and of solving the problems it presents. The appropriate behavior for analyzable tasks is contained in instructions, procedure manuals, computers data bases, and generally accepted bodies of knowledge. An analyzable task would be the case for an auditor verifying the bank account of a client. At the other end of the continuum, the transformation process is ill-defined and

unanalyzable. No store of explicit procedures or programs is available. To deal with problems that arise individuals may use trial and error, or they may "...rely upon a residue of something we do not understand at all well -- experience, judgment, knack, wisdom, intuition" (Perrow, 1970, p. 76). Unanalyzable technologies are often found in research organizations or strategic planning departments.

We used Perrow's (1970) concept of technology in this research for several reasons. The major reason is that it captures the degree of uncertainty in the tasks facing the department or organization and the uncertainty contained in the "programs" used by the organization to respond to the tasks. Thus technology subsumes a number of contextual factors, including the degree of task programmability, novelty, predictability, stability and homogeneity. Another reason is that technology, conceived of in this way, can be applied to any organizational task or sub-task. Further, it is readily operationalized (Banbury and Nahapiet, 1979), and validated instruments for measuring it are available (Withey et al., 1983).

Technology, as conceptualized by Perrow, is expected to influence the amount and focus of formal accounting and information systems. The logic is that variety in the tasks leads to an increase in the amount of information required for solving problems and completing work. New problems require additional information, and diverse tasks require broad information

resources. The analyzability of tasks determines the ambiguity or focus of the information. When tasks are unanalyzable (not well-understood) the task related information will not convey one clear, correct message, rather it will be ambiguous and have a multiple focus. Information tends to match the degree of equivocality in the organizational setting so that when tasks are ill-defined and equivocal, the information about the task will also be equivocal (Weick, 1969). Ambiguity in the organization's workflow means that information contained in accounting reports about that workflow will be less precise and more ambiguous than for routine, well-defined workflow (Thompson, 1972).

Research by Daft and Macintosh (1981) supported some of these ideas. They found an association between task analyzability and the amount of information processed in work-units. They speculated that when the task conversion process is analyzable, it can be broken down into its component parts and a body of knowledge will build up to handle problems as they arise. Consequently, a relatively large data base will emerge to serve these activities. But when tasks are unanalyzable, coding schemes to transmit data and information are hard to develop and use. Moreover, variety in the stream of tasks means that more information is required to cope with the work. This relationship is consistent with the law of requisite variety which asserts that control over a process requires enough variety in the information about the process to communicate the

variety in the task.

These ideas can be summarized in two hypotheses:

H-1: AS TASK VARIETY AND TASK ANALYZABILITY INCREASE THE AMOUNT OF FORMAL INFORMATION PROCESSED WILL INCREASE.

H-2: AS TASK VARIETY INCREASES AND TASK ANALYZABILITY DECREASES, THE PERCEIVED FOCUS OF THE FORMAL INFORMATION WILL INCREASE.

Personal Preference for Information Amount and Focus

The variables selected from the personal characteristics stream of research represent the personal preference for processing either large or small amounts of information and for processing either single-focus or multiple-focus information. Individuals differ in the amounts of information they use when making a judgment. At one extreme, minimal data individuals use just enough information to make an adequate decision; while at the other extreme individuals process as much relevant information as is available (Savich, 1977). Minimal data users "satisfice" on information processing. Maximal data users examine all relevant information and gather data until one or more excellent solutions emerge (Mock and Driver, 1975).

Information focus is an important attribute of accounting systems (Dyckman et al., 1972). Individuals differ systematically in the degree of focus they perceive in the data used to make decisions (Driver and Mock, 1975). At one extreme, multiple solution processors see information as having multiple focus and suggesting more than one conclusion; at the other extreme, single focus processors tend to see data as suggesting

one conclusion (McGhee et al., 1978). A multiple processor is flexible and sees information as having varied meaning; while a single focus processor is less flexible but consistent and sees information leading to one conclusion (Driver and Mock, 1975).

An individual's preference for processing either a small or large amount of information and the tendency to see either single or multiple meaning in the information influence how an individual uses information, makes decisions and gets work done. These influences are partially contained in the following hypotheses:

H-3: THE AMOUNT OF FORMAL INFORMATION PROCESSED AND USED BY INDIVIDUALS DURING TASK RELATED WORK IS ASSOCIATED WITH THEIR PERSONAL PREFERENCE FOR PROCESSING EITHER LARGE OR SMALL AMOUNTS OF INFORMATION, AND

H-4: THE DEGREE OF FOCUS PERCEIVED BY INDIVIDUALS IN FORMAL ACCOUNTING AND INFORMATION SYSTEMS IS ASSOCIATED WITH THEIR PERSONAL PREFERENCE FOR EITHER SINGLE OR MULTIPLE FOCUS INFORMATION.

The basic premise of the research, then, is to investigate the relative influence of the organizational characteristic of technology and the personal attributes of information preference for amount and focus of information on the perceived use of formal accounting and information system data. The research model is summarized in Figure 1.

-- Figure 1 About Here --

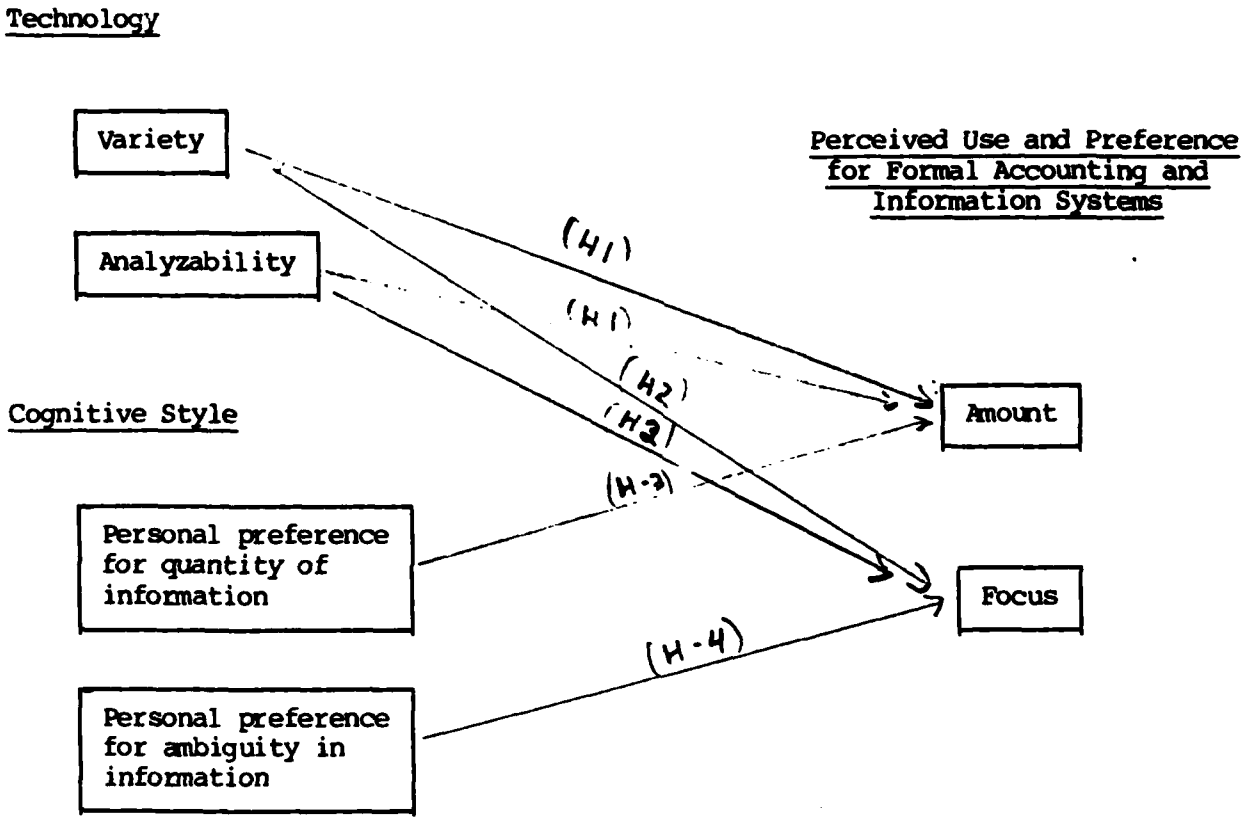


Figure 1. The research model.

METHOD

A field study was designed to test the research model. Laboratory experiments are well suited to control for individual differences, but field studies are excellent for evaluating a wide variety of organizational settings on the design and utilization of accounting and information systems (Swieringa and Weick, 1982). Field studies take advantage of the natural variations in technology that exist in the real world that are difficult to simulate under laboratory conditions. Field studies have proved valuable for investigating the effect of organization context variables on accounting and information systems (Khandwalla, 1972; Swieringa and Moncur, 1972; Bruns and Waterhouse, 1975; Hayes, 1977; Otley, 1978; and Merchant, 1981).

Measurement

Technology is an attribute of organizational arrangements (Perrow, 1970) and the theoretical relationship under investigation is the association of technology with the use of formal accounting and information systems. It was necessary to calculate scores for each department concerning technology and the characteristics of information used in that department. Work unit scores for technology and information characteristics were computed by averaging the scores for each respondent in the department. Personal preference for information amount and focus

were calculated separately for each individual in the study.

The instrument employed by Daft and Macintosh (1981) was used to measure the technology variables. It was investigated for convergent and discriminant validity by Withey et al. (1983), and was found to have acceptable validity and reliability. A factor analysis of the individual questionnaire items from our sample and the Cronbach alpha test for the two technology scales is shown in Table 1. These tests provide face

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-- Table 1 about here --

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validity that the questionnaire items tap the underlying dimensions of the technology constructs under investigation (Nie et al, 1975). Five items load on the analyzability dimension and five on the variety dimension.

For the department information dimensions questionnaire items similar to the Daft and Macintosh (1981) study also were used. These scales, unlike the technology scales, have not undergone independent validation against other instruments because no other instruments exist to measure information amount and focus. However, the factor analysis loadings of these items and the Cronbach alpha statistic for each scale shown in Table 2 provide evidence that the scales are conceptually independent,

-- Table 2 about here --

and that the scales are adequate to operationalize the constructs of formal information amount and focus in the department.

The operationalization of the personal preference for information constructs proved more problematic. Some studies have used Driver's (1971) Integrative Style Test (IST) where the subjects solve a business problem and then indicate on a test how they used the data in the problem (Driver and Mock, 1975; Savich, 1978; McGhee et al., 1978). The results of this test are used to measure an individual's preference for information and to categorize subjects by personal decision style. Unfortunately, the IST test was not made available to us so we developed our own scales. We considered other instruments, such as the Witkin (1969) embedded figures tests, which has been used in several research studies (Doctor and Hamilton, 1973; Lusk, 1973; Bariff and Lusk, 1977; Benbasat and Dexter, 1979; Benbasat and Dexter, 1982). However, no concensus has emerged as to either the appropriateness or the validity of this and other similar instruments and, in fact, some experts believe them to be inappropriate (Zmud, 1978; Keen and Bronsema, 1982). Further, such instruments do not operationalize the personal preference for information variables.

As a result we decided to use Likert-type questionnaire items using the same type of questions as for the department

information system. However, these questions were in a different section of the questionnaire, and respondents were instructed to think in terms of their own personal preference for using information, not on the job, but under all circumstances. The factor analysis and Cronbach's alpha test in Table 3 of the

-- Table 3 about here --

personal decision style questionnaire items suggest that the items are reliable measures of the personal preference constructs of information amount and focus.

Sample

The criteria used for selection of organizations in the sample was similar to other field studies relating organizational characteristics to organizational accounting and information systems. The main criterion was to ensure that the sample contained a range of departmental technologies. Selecting organizations on the basis of independent variable variation, rather than randomly enables investigators to test whether independent variables are having the predicted impact on dependent variables (Blalock, 1961 & 1972). This type of sample also permits extrapolation of findings across a range of organizations and work-units. It is an accepted technique in organizational theory research (Hall, 1962; Hall et al., 1967; Van de Ven and Delbecq, 1974; Van de Ven et al, 1976; Van de

Ven and Ferry, 1980) and it has been used by researchers investigating the effect of impersonal forces in the organizational context on accounting and information systems (Hofstede, 1967; Khandwalla, 1972; Bruns and Waterhouse, 1975; Hayes, 1977).

Following this strategy, data were collected from 142 individuals from 24 work units in a variety of organizations including: manufacturing firms, public utilities, service organizations, financial institutions and government agencies. A variety of departments were included: manufacturing, bank branches, R&D departments, clerical units, and foreign service offices. One-third of the individuals in each work-unit were selected randomly from lists of all fully trained and experienced department employees and were asked to complete the questionnaire. Participation was voluntary and nearly 70 percent did complete and return the questionnaire.

The data integrate both organizational and individual characteristics, so data were analyzed at the individual level of analysis. Department scores for technology were calculated as the average perception of all respondents from that department. These scores represent the context of the respondent. The personal preference score and the technology score were used to predict the characteristics of formal information used by respondents.

RESULTS

The general results are presented in Table 4. Partial

--- Table 4 About Here ---

correlation analysis was selected as a straightforward way to analyze the general associations of the technology and personal decision style variables with the way participants use and perceive formal accounting and information systems. The results generally support the relationships hypothesized earlier. In addition, other statistical tests, undertaken to assess the effect of decision style on the use of formal accounting and information systems, supported findings reported by other researchers.

Technology and Information Amount

It was hypothesized (H-1) that the amount of formal information system data processed would increase as tasks became more analyzable and as task variety increased. The results support this hypothesis. When task analyzability is high, participants do more processing of formal accounting and information system data than when it is low (partial r = .33). An explanation for this is that when the task conversion process is well understood, tasks can be broken down into their component

parts and a relatively large data base incorporating formal accounting and information systems is helpful in making decisions and checking progress toward goals. So participants perceive a greater use of from formal accounting and information systems when tasks are unanalyzable.

Task variety also was associated with the amount of formal accounting and information systems, although the relationship is weaker than for task analyzability (partial r = .22). As variety increases, the number of exceptions encountered by participants increases, so their search procedures are expanded and they seek and use more information than when tasks are routine. The correlation coefficient, however, is not large. What might be happening is that accounting information has the capacity to compress a great deal of information into line items such as net sales or cost of goods sold. Thus the formal accounting and information system may absorb some of the information detail through the use of standardized codes of accounts and aggregation of the accounts into specific line items on the accounting reports. In any event, when task variety increases participants did process more formal information, but not to the extent anticipated.

Technology and Information Focus

Task analyzability was also associated with the perceived focus of formal accounting and information system data (partial

r = -.50) in the direction hypothesized (H2). Presumably, when tasks are ill-defined, the data in formal accounting and information systems will be more ambiguous and less focused. When the techniques applied to the raw material (physical, human or intangible) are not analyzable, participants may rely on vague information sources (such as interpretation of previous experience, extrapolation of similar understanding, or empathy) to make decisions and carry out the task (Perrow, 1970). Under these conditions, it follows that formal accounting and information systems, incorporating data about the work, will tend to provide information containing multiple-focus meanings.

Task variety also proved to be associated with the perceived focus of the information in formal accounting and information systems (partial $r = -.23$). This implies that as the number of exceptions in the stream of tasks increases, the message contained in the information system becomes more equivocal. Paradoxically, then, the ability of accounting information to aggregate and compress information, generally recognized as an advantageous feature, may work at the same time to make the messages contained in the information more ambiguous.

Personal Decision Style and Information Characteristics

The personal decision style variables also appeared to influence the way participants used and perceived formal accounting and information systems, as predicted in hypotheses 3 and 4. As the data in Table 4 indicates, a personal preference

for processing a large amount of information was associated with the amount of processing participants undertook of formal accounting and information systems (partial r = .50). Likewise, a personal preference for either single or multiple focused information was associated with the perceived ambiguity of the data in the formal accounting and information system reports (partial r = .61).

Comparative Test

The next step in the analysis was to compare the relative effect of all four independent variables on the perceived amount and focus of formal accounting and information. Multiple regression analysis was used for this purpose and the standardized regression coefficients for these relationships are shown in Figure 2. These results, which are consistent with results

Figure 2 about here

reported in Table 4, suggest that task analyzability is the most influential independent variable. In this analysis, it was the only variable with a significant relationship to both dependent variables. Task analyzability (sometimes called task instrumentality or beliefs about cause/effect relationship or knowledge of the task conversion process) has been suggested by many authorities to have an important impact on accounting, information and control systems (Thompson, 1967; Perrow, 1970; Van de Ven et al., 1976; Ouchi, 1979; Randolph, 1979; Ouchi, 1979; Ouchi,

1980; Earl and Hopwood, 1980; Daft and Macintosh, 1981). As well, each personal decision style variable had the expected effect on the respective dependent variables while task variety did not emerge with a significant association.

Additional Analysis

In order to compare the results with previous studies, further analysis was conducted on the basis of personal decision styles. According to personal decision style theory, some individuals (Decisives) use a minimal amount of information and see information as generating one firm solution; other individuals (Flexibles), also use minimal data but see information as capable of containing different meanings at different times; others (Hierarchics) use masses of data which they massage with great thoroughness, precision and care to generate one best solution; and still others (Integratives) generate several solutions from the same information and use large amounts of data in a creative information loving fashion (Driver and Mock, 1975; Savich, 1977; Macintosh, 1981). These characteristics are similar to our personal preference scales for information amount and focus. The original research on decision styles used the Integrative Style Test, which we did not have access to. We did, however, attempt to replicate the existence of these styles and determine whether they are related to information use.

Participants were designated as one of the four decision styles according to their preference for either small or large amounts of information and their preference for single or multiple focus information. This was accomplished using the sample mean scores for the two attributes to split the subjects into categories. This resulted in the 2 x 2 table shown in Table 5. These data then were analyzed to determine whether there

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-- Table 5 about here --

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were differences among the four categories in terms of respondent's use and preference for formal accounting and information system data. These results are shown in Table 6.

-- Table 6 about here --

The Decisives, as decision style theory would predict, were significantly different from other styles for both amount and focus of information used. The Flexibles were different from the Hierarchics in the amount of formal information used. For the other combinations, the results generally conform to decision style theory, but the differences are not statistically significant. These results are similar to those of Driver and Mock (1975) and provide support for the idea that personal decision styles exist and influence the way participants use

formal accounting and information system data.

DISCUSSION

Limitations

Although the results supported the hypotheses, they must be considered in light of the limitations of the study. The sample was selected to obtain variation in the technology variables in order to investigate whether they had the predicted relationship with the way participants perceived and used formal accounting and information system data. This type of sampling is not random, although it has been accepted by organizational behaviour researchers for some time (Blalock, 1961; Hage & Aiken 1969; Glasser & Strauss, 1967). Nevertheless, the relationships may not be generalizable to other organization settings. Another limitation of the study is the reliance perceptual data. Respondents act as informants about the organization which may not be congruent with actual characteristics. Further, the operationalization of the personal decision style attributes was a preliminary undertaking because we had to design a new questionnaire. Although the scales seemed to be adequate measures of personal characteristics, we were not able to test it for validity and reliability in conjunction with the IST instrument. Comparison of our results with those of other studies using the IST should be done with caution.

Another type of limitation is that studies which find links between contingency variables and accounting and information system variables necessarily omit important intervening variables such as organization design and institutional purpose structures (Otley, 1980). As well, cross sectional samplings do not capture dynamic relations among variables (Dent and Ezzamel, 1982; Otley, 1982). These dynamics would require richer research paradigms relying on general systems theory and cybernetics (Mattesich, 1982).

Limitations notwithstanding, the results support the idea that both task characteristics and aspects of personality are related to the way participants perceive and use formal accounting and information system data. This may be important because effective information systems may have to reflect both task and personal needs of users. Four specific hypotheses were tested to investigate this general idea and all were [illegible] by the data. Our findings combined with previous research suggest three patterns that seem especially relevant to information system design and future behavioral accounting research.

The first pattern is the relationship between task analyzability and the amount of formal accounting and information systems data used by participants. When tasks are well defined, a body of knowledge and data can be developed about how to do the work. A relatively large data base including accounting information reflecting this can serve these tasks well (Daft and Macintosh, 1981), while a small data base tends to be used for

unanalyzable tasks.

This finding supports and builds upon other research into information relationships. Cyert and March (1963) maintained that when program conditions are uncertain, participants use problemistic rather than rationalistic search relying more on their own ability and experience to make decisions and less on formal information such as provided by the organization's accounting system. Similarly, Mintzberg (1973) posited that for the ill-structured part of their work, managers turn to soft and informal information and their own private networks which reveal more about intangible and poorly understood factors than do formal accounting and information systems. Banbury and Nahapiet (1979), using Perrow's concept of task analyzability, argued that when the tasks and actions can be completely specified they can be served well by formal information systems; whereas when they cannot be specified they are best served by informal and even personal information systems which exist entirely within the person doing the work. There is ample support, then, for the idea that the degree of task analyzability influences the amount of formal accounting and information systems data processed by organizational participants.

The question for future research is whether information systems provide data when managers need it least - when tasks are well defined and analyzable. Data may be used in greater volume because the data supply is high for measurable activities rather

than because demand is great. Users may need information help when things are ambiguous, and when formal data could help clarify poorly defined events and workflow activities. The relationship between task analyzability and data amount may mean that formal information is not available or used for the tough management decisions made under uncertainty. The role of formal versus informal data for unanalyzable activities may be an appropriate topic for future research that will have explicit design implications.

The second pattern is that clear, single focus information is not always preferred by users. For well understood tasks, formal accounting and information system reports, such as a standard cost system based on engineering job studies provide a clear, unambiguous message--the lower the costs the better. When budget targets are met it can be presumed that performance is satisfactory.

For ill-structured tasks, by contrast, the meaning obtained from data can be interpreted in different but equally tenable ways. It has been advocated, for example, that strategic planning managers can use the same data base to develop two completely logical but opposite plans (the plan and the counter plan), and then undertake a dialectic process whereby the conflict between the plan and the counter-plan are stressed to reach a more comprehensive synthesis plan (Mason, 1970). Information tends to match the degree of equivocality in the task

process in which the information applies (Weick, 1969), so crystallized realities lead to precise accounting reports, and ambiguous realities lead to ambiguous (Thompson, 1972).

The question for future research is whether the traditional assumption about user need for clear, detailed, single focus data is correct. The implication from current research is that data many times can be too exact and precise, and hence fail to fit the nature of certain tasks. Some managers and some tasks seem to require data that permits flexibility and personal interpretation for best results.

The third pattern in the literature is that findings about personal decision style are inconclusive. The most influential study provided evidence that some personal decision styles influenced, for complex but structured tasks, both the use and focus of information contained in accounting reports (Driver and Mock, 1975). The researchers, using a business game simulation, found that differences in personal decision style resulted in differences in both the frequency of purchasing accounting information and the decision speed. In another business game simulation, Decisives with incomplete reports outperformed Decisives with complete reports, and Integratives with complete reports outperformed Integratives with the incomplete ones. These findings support the idea that Decisives perform best with a minimal data base while Integratives do best with large amounts of data. For the Flexibles and Hierarchics the results were in

the direction expected but did not reach significant levels.

Subsequent tests of part of the decision style theory were not as supportive. One study investigating the relation between decision style and the amount of information processed found that Decisives were different from Flexibles and Integratives but that Flexibles did not differ from either Hierarchics or Integratives (Savich, 1977). In a similar study, McGhee et al. (1978) investigated the influence of personal decision style on both the perceived focus of information and the amount of information processed. The subjects, 24 MBA students specializing in accounting and finance, assumed the role of a junior security analyst and were asked to make recommendations about the "advisability of giving further consideration to including the stock of each firm in the investment portfolio of an insurance firm." The results, using an ANOVA statistical test did not indicate a significant difference between the one solution and the multiple solution subjects.

One explanation for lack of consistent findings is that the nature of the task in a laboratory experiment has a strong influence on the way accounting cues are used. Libby (1981) concluded that expert judges seem to emphasize a few key variables in forming judgements about specific tasks. The fact that some significant differences emerged in the studies described above, in spite of these limitations and measurement problems, could be interpreted as an indication of support for

the decision style theory, rather than that personality variables do not appear to be useful in describing, understanding or predicting human information processing.

On balance, the evidence from the literature shows more consistent support for user tasks than for user personality as a correlate of information utilization. The role of personal decision style is somewhat inconclusive, although we did find a relationship with information amount and focus in this study. Better answers will come with additional research because efforts at comparison and comprehensive theory building typically proceed slowly (Tiessen and Baker, 1977; Zmud, 1979; Keen and Bronsema, 1982; Huber, 1983; Robey, 1983).

CONCLUSION

This study investigated the impact of technology and personal preferences for information on the use of formal accounting and information systems. The results support the idea that both types of variables are important. Perrow's concept of technology seems promising as a way of capturing the effect of task and context on information processing.

There are implications in our results for accounting and information systems designers. Perrow's concept of technology provides a simple way of analyzing the work in any responsibility center. Designers can identify the type of technology and then design the system to be congruent with its needs rather than imposing one style of system on responsibility center. Failure to match information to task requirements may even result in system failure.

Hopwood (1976) cites the case where the accounting and systems people designed a complex planning, budgeting, scheduling and forecasting information system for a clothing firm. The system, which worked quite well for items with a relatively stable demand, such as underwear, was rejected eventually by the managers in the firm's teenage clothes operation because it consistently failed to forecast the peaks and troughs in demand for their high fashion items. The result was costly over or under stocking. The designers, failing to recognize the differences in the two operations, had imposed one style of

system on both parts of the organization. Daft and Macintosh (1978) cite the case where the financial control system for the R & D department of a large metal producing firm featured large amount of detailed data which the financial officer took to be unambiguous. The result was a great deal of explaining each month by the R & D vice-president over minor differences between actual and budgeted expenditures. Detailed, precise budget reports did not capture the ambiguity of R & D activities and the system was mis-used. An analysis of the ill-defined R&D technology would have provided the clues for a more effective financial control system.

Analysis of the personal traits of the managers who utilize the system also can be valuable. Barkin and Dickson (1977) report that in a large community nursing program the designers tested the managers for various personality traits and then designed a new accounting and control system accordingly. The managers were pleased with the new system and reported that it helped them to a much greater extent with their jobs than did the old one. Analysis of technology and personal traits, it seems, may both pay dividends in terms of effective accounting and information systems.

This study supports the idea that specific configurations of task characteristics and personal traits might dictate optimal formal information system design. A few researchers already have advanced theoretical frameworks along these lines. Driver and

Rowe (1980) outlined optimal information system design alternatives and optimal decision style, both dominant and backup, based on characteristics of the information-task environment. Macintosh (1981) set forth a contextual model of information systems incorporating technology, organizational structure, personal decision style and optimal formal information system design. Testing such theories as well as the development of new ones seems a promising direction for future research. Research frameworks of this sort might enable us to harness the many research findings of the past decade into real gains for the practitioner. As Mason and Mitroff (1973) and Mason and Mitroff (1983) suggest, formal accounting and information systems should be seen as part of the complex Geschtalt of organizational context, problem, task and psychological type.

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TABLE 1. Varimax Rotated Factor Matrix of Questionnaire Items for Work-Unit Technology

Questionnaire Items	Factor Loadings	
	Factor 1 (Analyzability)	Factor 2 (Variety)
Task Analyzability		
a. People actually rely on established procedure and practices	.82*	-.31
b. Normal work activities are guided by standard procedures, directives, rules, etc.	.77*	-.40
c. Need to know a lot of procedures and standard practices to do the work well	.72*	-.11
d. There is an understandable sequence of steps that can be followed in carrying out the work	.63*	-.32
e. Established materials (manuals, standards, directives, statutes, technical and professional books, and the like) cover the work	.60*	.01
Task Variety		
f. Tasks require an extensive and demanding search for a solution	-.08	.73*
g. Work decisions dissimilar from one day to the next	-.09	.68*
h. Variety in the events that cause the work	-.14	.66*
i. Describe the work as routine	.35	-.62*
j. Takes a lot of experience and training to know	-.26	.50*
Percentage of common variance explained	.77	.23
Eigen value	4.02	1.10
Cronbach's α	.80	.85

Respondents were asked to indicate the extent to which each statement described the work of their department on a five-point Likert scale where 1 = to a very great extent, 2 = to a great extent, 3 = to some extent, 4 = to a little extent, and 5 = to a very little extent.

* Item used in constructing the variable.

TABLE 2: Varimax Rotated Factor Matrix of Questionnaire Items for Formal Accounting and Information Systems Used in the Department

Questionnaire Items	Factor Loadings	
	Factor 1	Factor 2
Amount of Formal Accounting and Information Processed	(Amount)	(Focus)
a. Acquire all possible information before making a final decision	.76*	-.10
b. Wait until all relevant information is examined before deciding something	.66*	-.19
c. Go over available information until an excellent solution appears	.63*	.16
d. Keep gathering information until an excellent solution appears	.51*	.07
Focus of Formal Accounting and Information Systems		
e. The information can be interpreted in several ways and can lead to different but acceptable solutions	-.02	.85*
f. The information leads to more than one satisfactory solution for problems faced	-.01	.76*
g. The information means different things to different people	.01	.49*
Percentage of common variance explained	53.0	47.0
Eigen value	1.74	1.54
Cronbach's α	.74	.73

Respondents were asked to indicate the extent to which each statement described the way they used and processed formal accounting and information systems, during the normal course of doing their job, on a five-point Likert scale where 1 = to a very great extent, 2 = to a great extent, 3 = to some extent, 4 = to a little extent, and 5 = to a very little extent.

* Item used in constructing the variable.

TABLE 3: Varimax Rotated Factor Matrix of Questionnaire Items for Personal Preference

Questionnaire Items	Factor Loadings Factor 1	Factor 2
Personal Preference for Amount of Information	(Amount)	(Focus)
a. Wait until all relevant information is examined before deciding something	.62*	-.08
b. Keep gathering information until an excellent solution appears	.61*	-.04
c. Acquire all possible information before making a final decision	.58*	-.08
d. Go over available information until an excellent solution appears	.53*	-.01
Personal Preference for the Focus of Information		
e. Information that can be interpreted in several ways and can lead to different but acceptable solutions	-.08	.87*
f. Information that leads to more than one satisfactory solution for problems faced	.03	.60*
g. Information that means different things to different people	-.11	.41*
Percentage of common variance explained	58.5	41.5
Eigen value	1.58	1.12
Cronbach's α	.70	.65

Respondents were asked to indicate the extent to which each statement described their personal preference for the information they use to decide things both on and off the job on a five-point Likert scale where 1 = to a very great extent, 2 = to a great extent, 3 = to some extent, 4 = to a little extent, and 5 = to a very little extent.

* Item used in constructing the variable.

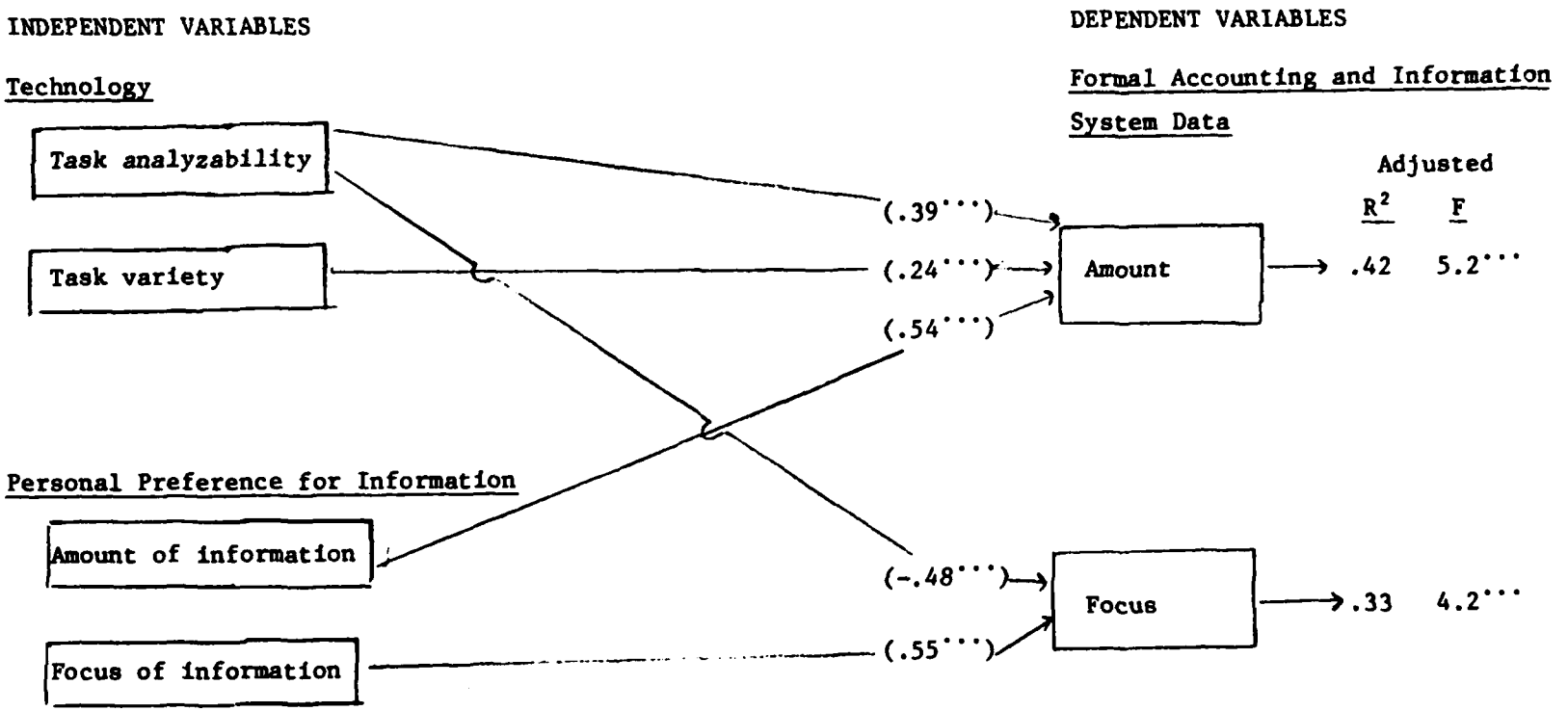
	DEPENDENT VARIABLES	
	FORMAL ACCOUNTING AND INFORMATION SYSTEMS DATA	
INDEPENDENT VARIABLES:	Amount	Degree of Focus
1. TECHNOLOGY:		
a. Task Analyzability	.38$^{...}$(.39$^{...}$)	-.50$^{...}$(-.54$^{...}$)
b. Task Variety	.22$^{...}$(.11)	-.23$^{...}$(-.01)
2. PERSONAL DECISION STYLE:		
a. Personal preference for amount of information	.50$^{...}$(.55$^{...}$)	-.01(-.02)
b. Personal preference for focus of information	-.11(-.14)	.61$^{...}$(.58$^{...}$)

Zero-order correlation coefficients in brackets

... $p < .01$
.. $p < .05$

The partial correlation coefficients were computed for each pair of independent variables by controlling for the other variable in the pair (e.g., the partial correlation for task analyzability is computed by controlling for task variety). The figures in brackets are the zero-order correlation coefficients of each independent variable with the dependent variables.

TABLE 4: Partial Correlation Coefficients of Technology and Personal Decision Style Variables with Formal Accounting and Information Systems Variables.



(Figures in brackets represent the significant (only) multiple regression beta coefficients for each independent variable with the dependent variables)

. $p < .10$
.. $p < .05$
... $p < .01$

Figure 2. Technology and Personal Preference Relationships with Formal Accounting and Information Systems Data

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